Paper / Subject Code: 40604 / Electromagnetic Field and Wave Theory

S.E. (Electrical) sem IV choice based 10/12/18 (111)

Q.P.Code: 38366

Duration: 3Hrs **Marks: 80**

Note: (1) Question No:1 is compulsory

(2) Attempt any three question from the remaining questions.

Q1. Solve any four from the remaining question. **(20)**

(a) State and explain Biot-Savart law.

(b) Explain current density and continuity equation.

(c) Convert P $(10,\pi/6,\pi/3)$ in cylindrical co-ordinates.

(d) Justify the statement "Divergence of a curl of a quantity is zero".

(e) Enlist five properties of electromagnetic wave.

Q2. (a) Evaluate both sides of divergence theorem for $D = x^2a_x + y^2a_y + z^2a_z$ over the cube $0<x,y,z<1$. **(10)**

(b) Two uniform line charges of density 8.854nC/m are located in a plane $z=0$ at $y = \pm 6$m. **(10)**

Find the E field at a point P (0, 0, 6).

Q3. (a) Derive Maxwell's equation in integral and point form for time varying field. **(10)**

(b) Derive the electric field intensity due to a infinite line charge. **(10)**

Q4. (a) Derive the Poisson's and Laplace equation. In Cartesian co-ordinates a potential is a function of x only. At X = -20cm, V=25V and $E = -1.5 \times 10^3\ a_x$ V/m throughout the region. Find V at X = 3 cm. **(10)**

(b) A charge distribution in free space has $\rho_v = 2r$ nC/m^3 in spherical co-ordinates, for $0<r<10$ m and zero otherwise. Determine **E** at r = 2m and r = 12m. **(10)**

Q5. (a) Given that $\mathbf{H} = \mathbf{H_m}\, e^{j(\omega t + \beta z)}\, \mathbf{a_x}$ (A/m) in free space, Find **E**. **(10)**

(b) A dielectric free space interface has the equation 3X + 2Y +Z = 12m. The origin side of the interface has $\epsilon_{r1} = 3$ and $\mathbf{E_1} = 2\mathbf{a_x} + 5\mathbf{a_z}$ (V/m). Find $\mathbf{E_2}$ **(10)**

Q6. (a) Transform given vector A in to cylindrical system $\mathbf{A} = y\mathbf{a_x} + x\mathbf{a_y} + \frac{x^2}{\sqrt{x^2+y^2}}\mathbf{a_z}$. **(10)**

(b) Starting from Maxwell equation obtain wave equation for the field E and H for free space. **(10)**

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